Pinedale Anticline Project Area

Draft

Greater Sage-Grouse Mitigation Action Plan

June 2013

BLM

Pinedale Field Office

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BLM/WY/ST-13/022+1110

BACKGROUND

The 2008 Final Supplemental Environmental Impact Statement Record of Decision (SEIS ROD) for the Pinedale Anticline Oil and Gas Exploration and Development Project includes a Wildlife Monitoring and Mitigation Matrix (WMMM) that identifies key wildlife species to be monitored and is designed to quantitatively identify specific changes in population size and/or habitat utilization that require mitigation should established thresholds be surpassed.

Greater Sage-grouse were identified as a key wildlife species and the WMMM defines criteria for monitoring in the Pinedale Anticline Project Area (PAPA) and outlines mitigation responses (Appendix 1). Six lek complexes are monitored annually for changes specified in the WMMM (Map 1). Lek attendance by male greater sage-grouse, number of active leks, and winter concentration area use were monitored in 2011 and 2012. Monitoring did not include nesting success and habitat selection as these criteria were removed from the WMMM in 2011 through the adaptive management process.

Monitoring was conducted by agency personnel from the WGFD and BLM. All occupied leks within the project area are counted in accordance with WGFD protocols (Appendix 2). In addition, searches for new leks are conducted annually to account for any shift in lek location or displacement of birds following disturbance.

The matrix threshold for a 30% decline in total number of active leks within the development area has two primary components:

1.) Compares the total number of active leks within each of the three development area complexes (Mesa, Duke's Triangle, Yellowpoint) to a 2007 baseline value for each complex.

2.) Compares the total combined number of active leks across all of the three development area complexes (Mesa, Duke's Triangle, Yellowpoint) to a combined 2007 baseline value.

Final analysis of 2012 monitoring data indicated a threshold was surpassed. In 2012 the Duke's Triangle complex saw a 50% decline in the number of active leks relative to the 2007 baseline. This decline exceeded the allowable threshold of no more than a 30% annual decline in the number of active leks in a single development area complex (Table 1).

Table 1: The number of active leks in the Duke's Triangle Complex and percent change relative to 2007 reference year data. Bolded entries indicate years when matrix threshold of no more than a 30% decline in a single year was surpassed.

Year	Number of Active Leks	Percent Change in Number of Active Leks*
2007	2	Reference Year
2008	3	50%

2009	**1**	**-50%**
2010	2	0%
2011	2	0%
2012	**1**	**-50%**

*Compared to 2007 reference year

For additional information on annual monitoring results please refer to the 2011-2012 Greater Sage-Grouse Annual Report for the Pinedale Anticline Project Area found at http://www.wy.blm.gov/jio-papo/papo/wildlife.htm.

REQUIRED MITIGATION RESPONSE

A performance based mitigation process is outlined in the WMMM with additional guidance information provided in the April 2, 2012 PAPA Wildlife Monitoring & Mitigation Plan (WMMP). Together, these two mitigation guidance components provide direction to the BLM for the agency to develop mitigation responses that are tailored in part to the specific impact and the affected species in order to proactively react to emerging undesirable changes such as declines in wildlife populations. The process is designed to allow for effective mitigation responses and a fluid pace of development throughout the life of the project area. The annual monitoring and the subsequent response to matrix thresholds is designed to provide certainty to both the agencies and public - that before consequences become severe or irreversible - negative impacts to wildlife will be addressed. To help achieve this, a sequential mitigation response was established in the SEIS ROD, detailed below. Based on the sequential process, mitigation responses will initially evaluate onsite measures followed by offsite measures, with the final step involving the consideration of the modification of operations by operators and the BLM.

ON-SITE

1. Protection of flank areas from disturbance (e.g., voluntary lease suspensions, lease buyouts, voluntary limits on area of delineation/development drilling) to assure continued habitat function of flank areas, and to provide areas for enhancement of habitat function
2. Habitat enhancements of SEIS area (both core/crest and flanks) at an appropriate (initially 3:1) enhancement-to-disturbance acreage ratio.

ON-SITE/OFF-SITE

3. Conservation Easements or property rights acquisitions to assure their continued habitat function, or provide an area for enhanced habitat function (e.g., maintenance of corridor and bottleneck passages, protection from development, establishment of forage reserves, habitat enhancements at an appropriate (initially 3:1) enhancement-to-disturbance acreage ratio.

MODIFICATION OF OPERATIONS

4. Recommend, for consideration by Operators and BLM, adjustments of spatial arrangement and/or pace of ongoing development.

This plan was designed to outline potential actions and objectives in response to meeting the previously discussed sage-grouse threshold in accordance with the established on-site and off-site criteria from options 1, 2, and 3. As stated in the WMMM sufficient time will be allowed for implemented mitigation measures to demonstrate the desired result before the next mitigation response is implemented. In the case that continued monitoring does not detect a desirable result

following the mitigation action the process will be repeated with additional responses from options 1, 2 or 3 until desired results and objectives are achieved. It is anticipated that all feasible responses from options 1, 2 and 3 will be exhausted and allowed sufficient time to achieve desired results prior to the consideration of response 4 modification of operations.

PLAN DEVELOPMENT

Following the official announcement that a matrix threshold had been surpassed at the wildlife annual planning meeting on February 20th, 2013 a follow-up public meeting was held on March 14th, 2013. At this follow-up meeting the BLM presented different types of projects and actions with the potential to benefit sage-grouse the BLM can or previously has implemented. The public and interested parties were then provided the opportunity to present ideas, voice concerns and ask questions regarding the decline in the number of active leks in Duke's Triangle. In addition to public input a series of internal discussion with staff and cooperating agencies were conducted in order to identify the type, location, feasibility, and estimated cost of potential projects. All information collected was used to develop the current mitigation plan and specific objectives to guide response actions to address the emerging trend of declining lek activity.

In accordance with the WMMM sequential mitigation process a three part strategy was developed in order to prioritize on-site and off-site mitigation actions.

1. Immediate - projects conducted on-site (within Duke's Triangle)
2. Within 2 years - projects conducted both on-site and near-site (within PAPA)
3. Longer term - projects conducted off-site (outside of PAPA)

For the purposes of this plan on-site responses have been divided into two categories; on-site being within the Duke's Triangle Complex and near-site being the remaining lek complexes that comprise the rest of the PAPA (Map 2). Offsite is defined as suitable grouse habitat outside of PAPA boundaries. A timeline of two-years was established before consideration of projects outside of Duke's Triangle and within other parts of the PAPA can occur.

Initial mitigation efforts will focus directly on improving and creating conditions more amenable to sage-grouse in the complex (Duke's Triangle) that met the matrix threshold in an attempt to increase population levels. Efforts to improve conditions and mitigate other areas of the PAPA with sensitive sage-grouse habitat will then be allowed to proceed in order to reduce the potential for other complexes to experience declines beyond the 30% threshold. Off-site projects outside of the PAPA will only be considered once it has been determined through the monitoring of mitigation responses that on-site and near-site projects have not and will not result in a desired response. There is no established timeline for implementation of off-site projects.

MITIGATION RESPONSE OBJECTIVES

In order to prioritize and identify the most beneficial response actions a series of objectives were developed outlining the key components of grouse biology and habitat requirements to be targeted through mitigation (Table 2). Proposed actions were only considered for implementation if they met at least one of the established objectives. Projects that met multiple objectives were considered a priority response action.

Table 2: Mitigation response objectives to matrix threshold established using public and internal input. Objectives are assigned a number to assist in future reference.

Objective Number	Mitigation Response Objective
1	Increase the quality, quantity, abundance, or distribution of key forage for chicks and hens during the key periods of nesting and early brood rearing in areas of documented use
2	Increase the quality, quantity, abundance, or distribution of key forage for chicks and hens during the period of late brood rearing in areas of documented use
3	Manage the timing of certain aspects of the Development Program to reduce noise and light impacts within 2 miles of leks and key nesting habitat areas
4	Establish and maintain a collaborative group of operators, users, and producers to ensure communication, promote broad support and maximize opportunities.
5	Collect quantitative plant community composition and plant species specific habitat condition data within priority habitat areas in order to identify treatment areas and monitor mitigation response
6	Manage all treatments to minimize mechanical disturbance of sagebrush in delineated winter concentration areas
7	Reduce the impacts of existing surface facilities on sage grouse movement and habitat use
8	Reduce predation probability and other opportunities for mortality

MITIGATION AREAS

According to the WMMM mitigation priority should be given to habitats designated as the most crucial or important. In order to assess the mitigation potential of defined areas enabling prioritization of locations for mitigation action a model was developed (Appendix 3). This theoretical model combined a variety of population and habitat use parameters and assigned a quantitative mitigation potential score to a set of predefined project areas. By stratifying the potential value of set areas based on grouse population and habitat use patterns land managers are able to direct initial mitigation efforts to areas of greater potential value with the goal of initiating a positive response in bird numbers. It is important to note that final verification of each priority area must be conducted through on the ground searches and data collection. The ability of any area to sustain a population of any species, regardless of management practices cannot be fully evaluated from anywhere but the ground.

The model was conducted for both on-site areas within Duke's Triangle and near-site locations throughout the rest of the PAPA. Initially, existing disturbance was buffered by 50 meters and removed from the analysis. It is important to note that these development areas while not ideal for habitat or conservation based actions still possess potential for incorporation of management action that reduce disturbance levels. Using professional judgment the mitigation areas were developed from the remaining portions of the PAPA using known disturbance buffers, winter concentration areas, sage grouse complex areas, nesting/observation points, and areas that exhibit

different levels of estimated bird use (Map 2). A total of 9 on-site and 28 near-site mitigation areas were delineated.

Following the delineation of mitigation areas the model was run generating two key outputs. First, the potential for mitigation benefit (PfM) was calculated. Parameters included in this estimate included information on occupied and un-occupied leks, winter concentration areas, nesting areas and bird observations from radio collaring and field observations. Second, an estimate of percent habitat within each mitigation area (%USE) was calculated using existing habitat data. The scores for both PfM and %USE were then assigned a score from 1-4 based on their estimated mitigation potential and current level of grouse use. It is important to note that higher scores were assigned to areas of %USE that ranged from 40-80% not >80%. This was done in order to prioritize areas that demonstrated some level of bird use but still possessed the potential for increased habitat utilization. The scores were then combined with the resulting final total score indicating the potential benefit of conducting mitigation actions for each area (Table 3). It is important to note that the areas selected by the model represent an initial screening for mitigation potential and will serve as a guide for field personnel in the identification of potential mitigation actions. Depending on the results of field determinations additional locations may be selected for potential mitigation actions outside of those identified as priority areas in the model.

Table 3: Final output of the Potential for Mitigation (PfM) model. The % USE and PfM score for each mitigation area were assigned a score from 1-4 which resulted in maximum cumulative total score of 8. Greyed areas indicate those selected as priority mitigation areas.

	Area	% USE	PfM	%USE Score	PfM Score	Total Score
On-site	*DT-7*	*78.37%*	*910.65*	*4*	*4*	*8*
	DT-4	*32.57%*	*453.89*	*3*	*4*	*7*
	DT-9	*45.33%*	*186.34*	*4*	*3*	*7*
	DT-8	12.78%	231.43	2	3	5
	DT-5	14.55%	88.19	2	2	4
	DT-6	24.76%	40.98	3	1	4
	DT-3	4.25%	75.75	1	2	3
	DT-2	12.52%	41.59	2	1	3
	DT-1	657.43%	23.53	1	1	2
Near-site	*NS-19*	*61.60%*	*580.83*	*4*	*4*	*8*
	NS-7	*66.82%*	*511.89*	*4*	*4*	*8*
	NS-3	72.01%	356.63	4	4	8
	NS-27	60.14%	326.27	4	4	8
	NS-13	*86.40%*	*653.07*	*3*	*4*	*7*
	NS-26	82.74%	457.17	3	4	7
	NS-22	54.19%	168.66	4	3	7
	NS-2	42.18%	156.91	4	3	7
	NS-11	51.29%	149.77	4	3	7
	NS-20	69.82%	130.15	4	3	7

	NS-23	32.31%	149.93	3	3	6
	NS-16	61.68%	55.49	4	2	6
	NS-15	94.37%	142.06	2	3	5
	NS-1	29.85%	70.43	3	2	5
	NS-8	59.36%	15.51	4	1	5
	NS-5	100.00%	126.45	1	3	4
	NS-14	94.61%	94.65	2	2	4
	NS-25	17.86%	73.37	2	2	4
	NS-21	35.04%	40.44	3	1	4
	NS-6	100.00%	71.94	1	2	3
	NS-12	12.89%	63.65	1	2	3
	NS-28	0.41%	63.64	1	2	3
	NS-9	12.70%	60.01	1	2	3
	NS-17	14.23%	36.62	2	1	3
	NS-18	6.20%	46.29	1	1	2
	NS-24	7.15%	28.81	1	1	2
	NS-4	13.29%	4.54	1	1	2
	NS-10	0.00%	14.56	0	1	1

For the purposes of this plan the areas identified in the model with the greatest mitigation potential to benefit grouse populations constitute the most crucial or important areas to focus mitigation efforts within as outlined in the WMMM. In order to account for potential mitigation projects within more intensively developed areas a Development Zone project area was delineated. The top three on-site locations and top three near-site locations outside of intensive development are discussed below.

ON-SITE Mitigation Priority Areas (Map 4)

- **DT-7**: This area consists of 6882 acres and is found on the eastern portion of Duke's Triangle. This area exhibits the highest level of current year-round sage-grouse use within the complex. A significant portion of the area (3558 acres) is comprised of winter concentration habitat. The eastern portion of the area (3181 acres) is within designated Core habitat. The only remaining active lek in Duke's Triangle (Lower Sand Springs Draw) is located in this area. There is a single unoccupied lek (East Fork Hill) within the area. There are multiple springs, water well, and reservoirs within the area making potential riparian improvement projects possible. Projects in this area are likely to directly benefit more grouse than any other on-site location. However, any action should consider the benefit of improving habitat values without compromising the important role this area currently plays in maintaining the Duke's Triangle grouse population, and incorporate appropriate consideration to disturbance restrictions relating to Core habitat set forth in BLM IM WY-2012-019.

- **DT-4**: This area consists of 6163 acres and is located west of Middle Crest Road directly adjacent to the development zone. The area is primarily comprised of relatively flat to low rolling topography with Wyoming sage-brush being the dominant vegetative species.

There is little to no riparian habitat within the area. Approximately 600 acres of Wyoming Sage-grouse Core Habitat is located on the western edge with a single unoccupied lek (Little Fred Satellite) within the area. Nesting locations have been documented throughout the area, however, the level of grouse use has declined in recent years likely due to the reduction in activity at the Big Fred and Little Fred Satellite leks. The primary objective for projects in this area would be the improvement of habitat conditions in order to support additional grouse populations.

- **DT-8**: This area consists of 2310 acres and is located in the southeastern most corner of Duke's Triangle. Approximately 200 acres of Core habitat is located in the Northeast portion of the area. There are no documented leks within the area, the nearest occupied lek (Little Fred) is approximately 1.3 miles to the Northwest. The area is characterized by rolling topography dominated by sagebrush with riparian habitat associated with Sand Springs Draw located on private land. The primary benefit to grouse from BLM administered lands is nesting and early brood rearing habitat. Projects across all landownership types would be designed to improve nesting and early and late brood rearing habitats.

NEAR-SITE Mitigation Priority Areas (Map 5)

- **NS-13**: This near-site mitigation area presented the highest PfM estimate from the model. It's %USE score exceeded 80% resulting in a total score of only 7, however this location was selected as a priority mitigation area due to its proximity to the Duke's Triangle complex and high PfM score. It consists of 13123 acres and is located west of the primary natural gas development in the northern portion of the Yellowpoint complex. This complex is one of the three development area complexes monitored in the WMMM. There is no Core habitat within the area but there are two occupied and active leks Little Saddle and Alkali Draw. The majority of the area (8651 acres) is comprised of delineated winter concentration habitat. The area represents suitable nesting habitat with several water wells, reservoirs, and springs available for mitigation projects directed towards late brood rearing habitat. Given the low level of anthropogenic development in the area projects designed to improve nesting and early and late brood rearing would be most beneficial.

- **NS-19**: The area consists of 15582 acres and is located east of Hwy 191 in the western portion of the Speedway complex. This complex is one of the three reference area complexes monitored in the WMMM. The entire area is located within designated Core habitat and there are 3 occupied leks within the area, Speedway, Hole-2 and Waterhole Draw. The area contains a total of 6260 acres of delineated winter concentration habitat. The area is dominated by rolling topography and sagebrush making it suitable nesting habitat. There are multiple springs, water well, and reservoirs within the area making potential riparian improvement projects possible. The southern portion of the area is within the Rock Springs BLM field office. Projects looking to improve nesting and early and late brood rearing habitats would be most beneficial in this area with consideration to disturbance restrictions relating to Core habitat set forth in BLM IM WY-2012-019.

- **NS-7**: The area consists of 11651 acres and is located on the southwestern portion of the Mesa in the Mesa complex. This complex is one of the three development area complexes monitored in the WMMM. The majority of the area, 8688 acres, is designated Core habitat. There is a total of 6010 acres of winter concentration habitat and three occupied leks, Bloom Reservoir, Cat, and Lovatt West in the area. This area also represents crucial winter range for both pronghorn and mule deer. Several springs or water developments are present enabling potential projects to be directed towards improvement of late brood rearing habitat. In this area project objectives would be focused on the improvement of nesting and early and late brood rearing habitats with appropriate consideration to disturbance restrictions relating to Core habitat set forth in BLM IM WY-2012-019.

DEVELOPMENT ZONE

- The development zone extends throughout the three development area complexes. Due to the high levels of disturbance and consistent human presence projects designed to improve habitat conditions would likely have limited value. There are however several managements actions that could reduce the types and levels of existing disturbance. Many of these actions will require close coordination with operators in order to maintain a fluid pace of development while providing benefits to wildlife.

POTENTIAL MITIGATION ACTIONS

Following the development of the overall strategy, objectives and priority locations potential mitigation actions were then analyzed using several parameters in order to determine their feasibility and how they fit within the strategy framework. These parameters were used as an attempt to quantify whether the proposed actions were reasonable in nature, readily available, and timely to implement. The primary objective was to identify projects that will provide the quickest benefit to the grouse population of interest in the most responsible manner. Parameters considered included the following:

- **Type of Action** – Habitat manipulation, management action or conservation action
- **Potential Implementation Timeline** – Determine reasonable timeframe of project implementation and how it fits within the mitigation strategy.
- **Mitigation Objectives** – Which Mitigation Response Objectives will the project meet?
- **Benefits** – How will the project benefit sage-grouse populations? Will benefits be realized over the long-term or short-term? Are there benefits to other wildlife species or resources?
- **Risks/Negative Impacts** – What are potential negative impacts both to sage-grouse and other wildlife populations as well as resource based industries?
- **Responsible Party/Agency** – Identify the agency or party with primary responsibility. Identify all other potential cooperators and interested parties.
- **Estimate Cost** – Is the cost to implement the proposed mitigation action reasonable? Are there potential funding sources for the proposed project?
- **Applicable On-site (within Duke's Triangle)** – Does the project meet all requirements for immediate implementation?
- **Applicable Near-site (within PAPA)** – Does the project meet all requirements for implementation within two-years?

Within each priority area a list of potential mitigation projects was compiled and summarized for consideration (Table 4). Each area will be thoroughly examined on the ground to verify the

potential and feasibility of conducting possible projects. All actions will within designated Sage-grouse Core areas will adhere to disturbance restriction set forth in BLM IM WY-2012-019.

Table 4: Summary of the types of mitigation responses and the mitigation area where they could potentially be applicable

Mitigation Response	Mitigation Areas*	Objectives to be met**	Potential for Implementation	Required NEPA	Cost Estimate
Increase Forb composition by inter-seeding or fertilizing n habitats currently being used by birds (with or without brush disturbance)	DT-7, DT-4, DT-8, NS-19, NS-13, NS-7	1, 2, 4, 5, 6	Fall 2014	EA	$300/acre
Increase Forb composition by inter-seeding or fertilizing in habitats not used currently, due to declines, to improve habitat for eventual bird return (with or without brush disturbance)	DT-7, DT-4, DT-8, NS-19, NS-13, NS-7	1, 2, 4, 5, 6	Fall 2014	EA	$300/acre
Enhance existing riparian areas	DT-7, DT-8, NS-19, NS-13, NS-7	2, 4, 5	Fall 2014	EA	$20,000/location
Develop new riparian areas at water developments	DT-7, DT-4, NS-19, NS-13, NS-7	2, 4, 5	Fall 2014	EA	$40,000
Enhance reclamation response through cooperation with operators	Development Zone	1, 4, 7	Immediate	None	$0
Convert existing windmills to solar	DT-7, NS-19, NS-13, NS-7	4, 7, 8	Immediate	CX	$30,000
Mark fences in high risk areas with strike diverters	DT-7, DT-4, DT-8, NS-19, NS-13, NS-7	4, 7, 8	Immediate	None	$1/marker
Modify existing fences (wire, posts) and remove unneeded posts	DT-7, DT-4, DT-8, NS-19, NS-13	4, 7, 8	Immediate	None	$3-5/foot
Schedule maintenance activities outside lekking periods except in emergencies	Development Zone	3, 4, 7	Immediate	None	$0
Schedule pad construction activity within ¼ mile of leks outside lek periods, especially in April	Development Zone	3, 4, 7	Immediate	None	$0
New signage in areas of high sage grouse use to reduce collision with vehicles	DT-7, DT-4, DT-8, NS-19, NS-13, NS-7, Development Zone	4, 7, 8	Immediate	CX	$3000-$6000

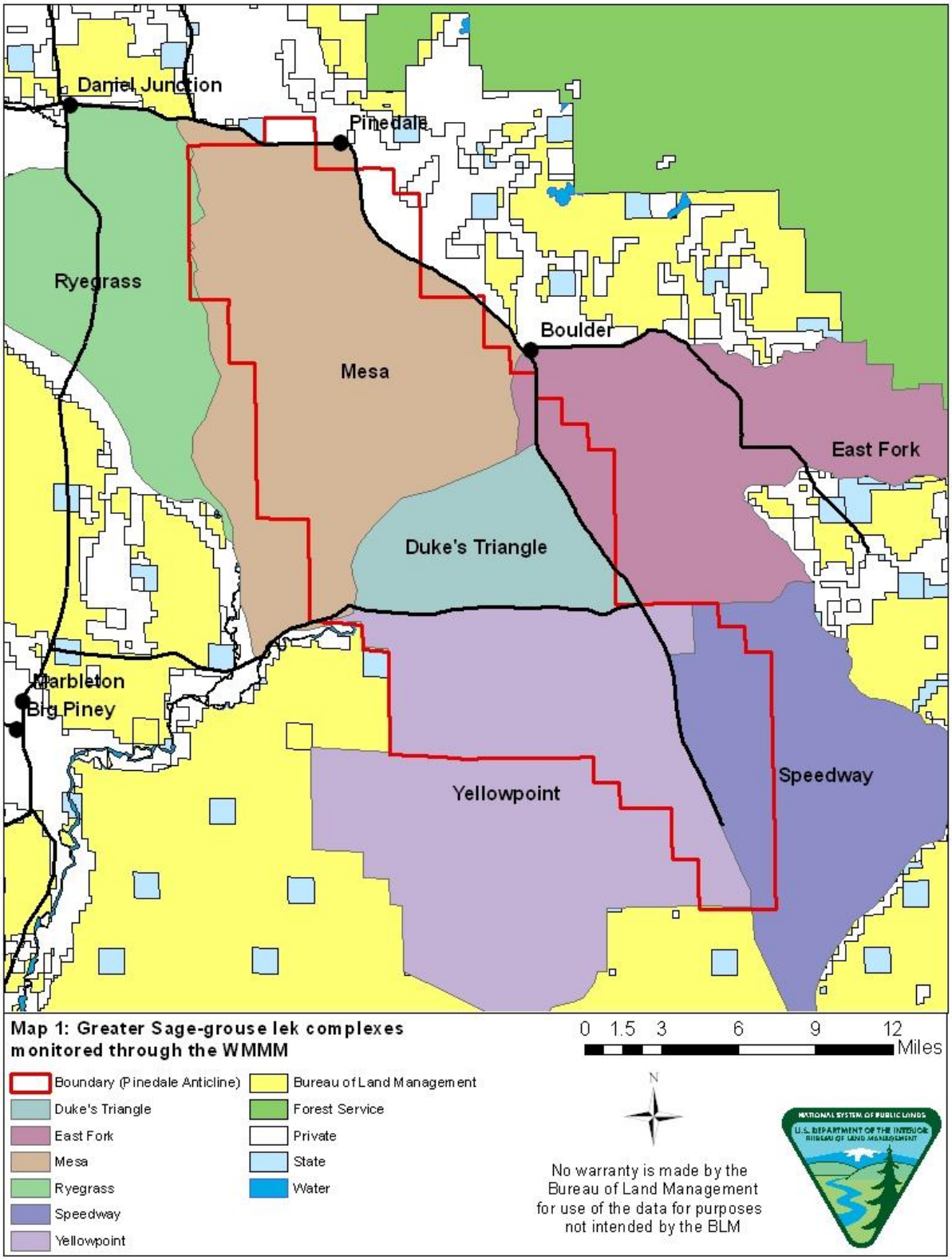
Continue noise mitigation efforts at development locations within key grouse habitats	Development Zone	3, 4, 7	Immediate	None	$0

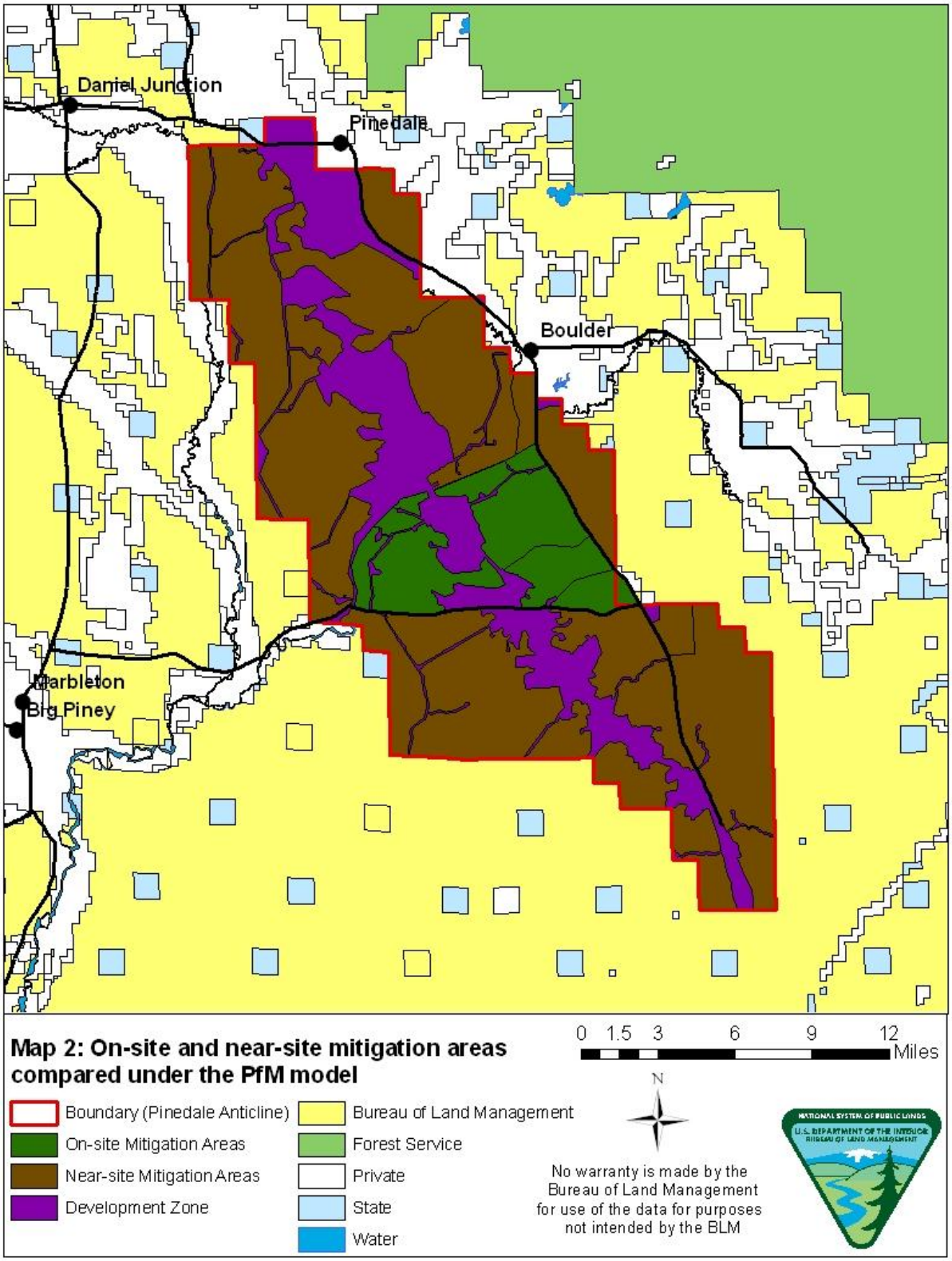
* Project area number assigned on Maps 3&4

** Objective number assigned in Table 2

PLAN IMPLEMENTATION

In order to provide the most efficient response to the mitigation threshold and benefit the remaining sage-grouse population within Duke's Triangle on-site mitigation responses with the potential for immediate action will be initiated upon approval of this plan. For actions that require further development through the NEPA planning process coordination and communication with potential partners, users, and operators will be initiated. Technical review teams will be established in order to review project potential, develop project parameters and set objectives, and complete required planning documents. Progress on plan implementation will be annually reported to the public and interested parties at the PAPA Wildlife Annual Planning Meeting.


Daniel Junction
Pinedale
Ryegrass
Boulder
Mesa
East Fork
Duke's Triangle
Marbleton
Big Piney
Yellowpoint
Speedway
Map 1: Greater Sage-grouse lek complexes monitored through the WMMM
0 1.5 3 6 9 12
Miles
N
Boundary (Pinedale Anticline)
Duke's Triangle
East Fork
Mesa
Ryegrass
Speedway
Yellowpoint
Bureau of Land Management
Forest Service
Private
State
Water
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM


Daniel Junction
Pinedale
Boulder
Marbleton
Big Piney
Map 2: On-site and near-site mitigation areas compared under the PfM model
Boundary (Pinedale Anticline)
On-site Mitigation Areas
Near-site Mitigation Areas
Development Zone
Bureau of Land Management
Forest Service
Private
State
Water
0 1.5 3 6 9 12
Miles
N
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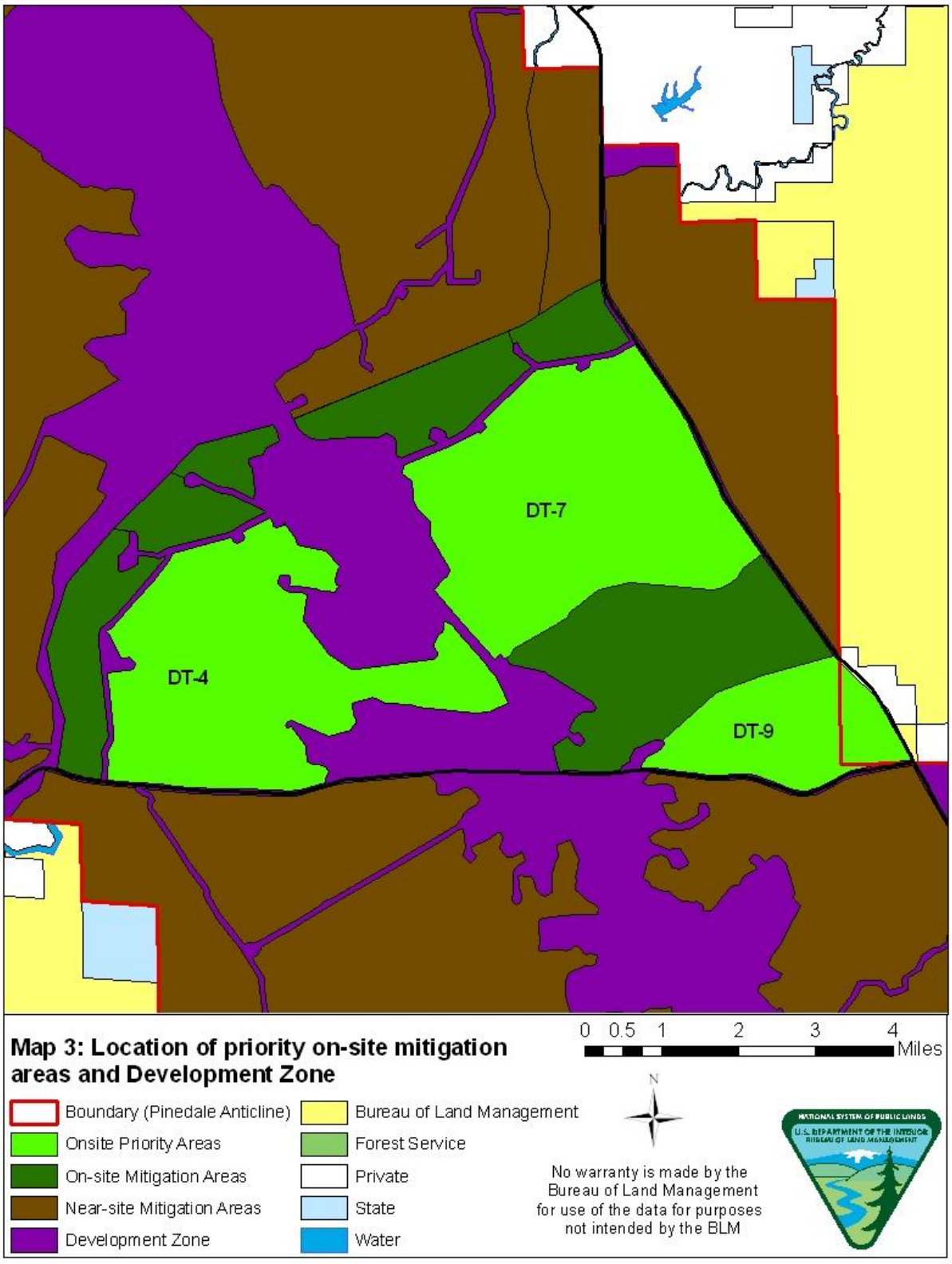
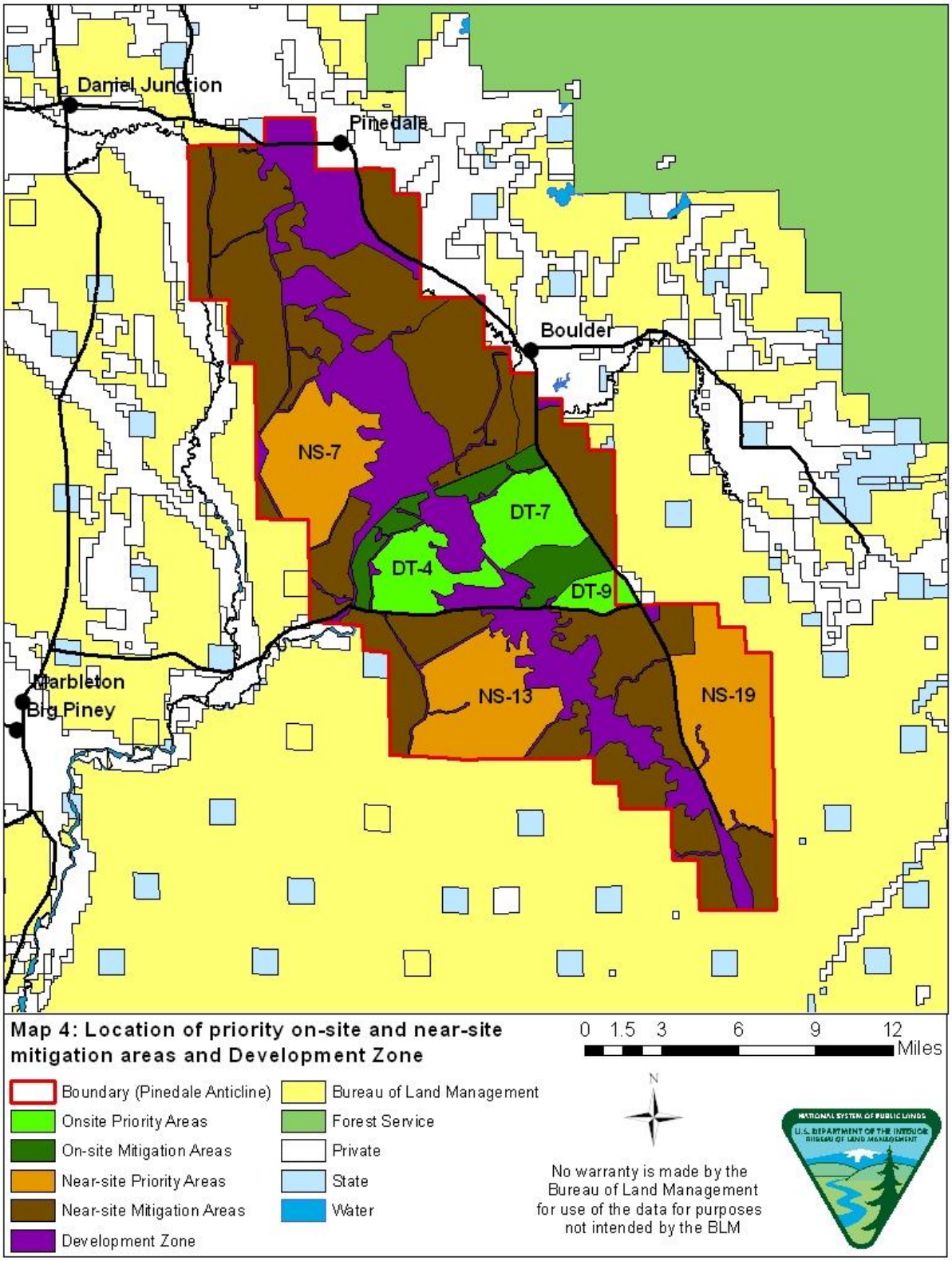


Map 3: Location of priority on-site mitigation areas and Development Zone


Daniel Junction
Pinedale
Boulder
NS-7
DT-7
DT-4
DT-9
NS-13
NS-19
Marbleton
Big Piney
Map 4: Location of priority on-site and near-site mitigation areas and Development Zone
0 1.5 3 6 9 12
Miles
N
Boundary (Pinedale Anticline)
Onsite Priority Areas
On-site Mitigation Areas
Near-site Priority Areas
Near-site Mitigation Areas
Development Zone
Bureau of Land Management
Forest Service
Private
State
Water
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

Appendix 1: Wildlife Monitoring and Mitigation Matrix Greater Sage-grouse thresholds from Appendix B 2008 PAPA SEIS ROOD, as modified in 2011.

Species	Criteria	Method	Changes that will be monitored	Specific Changes Requiring Mitigation	Mitigation Responses
Sage grouse	Number of active leks in identified lek complexes	Lek counts according to protocol	Active use on 70% of total current leks; Active use on 70% of leks in each complex (the development area complexes include the Mesa, Duke's Triangle, and Yellow Point complexes) compared to 2007 data	30% decline in total number of active leks, or 30% decline in the number of leks in a single complex	Select mitigation response sequentially as listed below, implement most useful and feasible and monitor results over sufficiently adequate time for the level of impact described by current monitoring.
	Peak number of males attending lek complexes	Lek counts according to protocol	Total average 2-year change in numbers of males attending development area lek complexes (the Mesa, Duke's Triangle, or Yellow Point lek complex), compared to the East Fork, Speedway, or Ryegrass reference lek complexes	Average of 30% decline in numbers over 2 years compared to reference area	Select mitigation response sequentially as listed below, implement most useful and feasible and monitor results over sufficiently adequate time for the level of impact described by current monitoring.
	Winter concentration area use	Monitoring according to protocol	Change in winter concentration area use compared to reference area (once initial data is available), and a concurrent change in the total average 2-year numbers of males attending development area lek complexes (Mesa, Duke's Triangle, of Yellowpoint lek complexes), compared to the East Fork, Speedway, or Ryegrass reference lek complexes	Average of 15% per year decline in amount of winter habitat used over 2 years compared to reference areas, and a concurrent average of 30% decline in numbers over 2 years compared to reference area	Select mitigation response sequentially as listed below, implement most useful and feasible and monitor results over sufficiently adequate time for the level of impact described by current monitoring.
	Noise Levels	Decibel monitoring from March 1-May 15 at lek sites	Noise levels demonstrated to impact peak lek use by male sage grouse and a concurrent change in the total average 2-year numbers of males attending development area lek complexes (Mesa, Duke's Triangle or Yellowpoint lek complexes), compared to the East Fork, Speedway, or Ryegrass reference lek complexes	Decibel levels at the lek more than 10 dBA above background measured from the edge of the lek (2000 ROD, p.27), and a concurrent average of 30% decline in peak numbers of male birds over 2 years vs. reference area.	Select mitigation response sequentially as listed below, implement most useful and feasible and monitor results over sufficiently adequate time for the level of impact described by current monitoring.

Appendix 2: WGFD Monitoring Protocols and Classifications

Wyoming Sage-Grouse Definitions:
(Revised 02/09/2010)

The following definitions have been adopted for the purposes of collecting and reporting sage-grouse data. See the sage-grouse chapter of the Wyoming Game and Fish Department's Handbook of Biological Techniques for additional technical details and methods.

Lek - A traditional courtship display area attended by male sage-grouse in or adjacent to sagebrush dominated habitat. A lek is designated based on observations of two or more male sage-grouse engaged in courtship displays. Before adding the suspected lek to the database, it must be confirmed by an additional observation made during the appropriate time of day, during the strutting season. Sign of strutting activity (tracks, droppings, feathers) can also be used to confirm a suspected lek. Sub-dominant males may display on itinerant (temporary) strutting areas during population peaks. Such areas usually fail to become established leks. Therefore, a site where small numbers of males (<5) are observed strutting should be confirmed active for two years before adding the site to the lek database.

Satellite Lek – A relatively small lek (usually less than 15 males) that develops within about 500 meters of a large lek during years of relatively high grouse numbers. Locations of satellite leks should be encompassed within lek perimeter boundaries. Birds counted on satellite leks should be added to those counted on the primary lek for reporting purposes.

Lek Perimeter – The outer perimeter of a lek and any associated satellites. Perimeters should be mapped by experienced observers using established protocols for all leks with larger leks receiving higher priority. Perimeters may vary over time as population levels or habitat and weather conditions change. However, changes to mapped perimeters should occur infrequently and only if grouse use consistently (2+ years) demonstrates the existing perimeter to be inaccurate. A point **within** the lek perimeter must be recorded or calculated as the identifying location for the lek. The point may be the geographic center of the perimeter polygon as calculated though a GIS exercise or a GPS point reflecting the center of breeding activity as typically witnessed on the lek.

Lek Complex - A lek or group of leks within 2.5 km (1.5 mi) of each other between which male sage-grouse may interchange from one day to the next.

Lek Count - A census technique that documents the actual number of male sage-grouse observed attending a lek complex. The following criteria are designed to assure counts are done consistently and accurately, enabling valid comparisons to be made among data sets. Additional technical criteria are available from the WGFD.

- Conduct lek counts at 7-10 day intervals over a 3-4 week period after the peak of mating activity. Although mating typically peaks in early April in Wyoming, the number of males counted on a lek is usually greatest in late April or early May when attendance by yearling males increases.
- Conduct lek counts only from the ground. Aerial counts are not accurate and are not comparable to ground counts.
- Conduct counts from ½ hour before sunrise to 1 hour after.
- Count attendance at each lek a minimum of three times annually during the breeding season.
- Conduct counts only when wind speeds are less than 15 kph (~10 mph) and no precipitation is falling.
- All leks within a complex should be counted on the same morning.

Lek Count Route – A lek route is a census of a group of leks that are relatively close and represent part or all of a single breeding population/sub-population. Leks should be counted on routes to facilitate repetition by other observers, increase the likelihood of recording satellite leks, and account for shifts in breeding birds if they occur. Lek routes should be established so that all leks along the route can be counted within 1.5 hours following the criteria listed under "Lek Count".

Lek Survey - Ideally, all sage-grouse leks would be counted annually. However, some breeding habitat is inaccessible during spring because of mud and snow, or the location of a lek is so remote it cannot be routinely counted. In other situations, topography or vegetation may prevent an accurate count from any vantage point. In addition, time and budget constraints often limit the number of leks that can be visited. Where lek counts are not feasible for any of these reasons, surveys are the only reliable means to monitor population trends. Lek surveys are designed principally to determine whether leks are active or inactive, requiring as few as one visit to a lek. Obtaining accurate counts of the numbers of males attending is not essential. Lek surveys involve substantially less effort and time than lek counts. They can also be done from a fixed-wing aircraft or helicopter. Lek surveys can be conducted from the initiation of strutting in early March until early-mid May, depending on the site and spring weather.

Annual status – Lek status is assessed annually based on the following definitions:

- **active** – Any lek that has been attended by male sage-grouse during the strutting season. Acceptable documentation of grouse presence includes observation of birds using the site or signs of strutting activity.
- **inactive** – Any lek where sufficient data suggests that there was no strutting activity throughout a strutting season. Absence of strutting grouse during a single visit is insufficient documentation to establish that a lek is inactive. This designation requires documentation of either: 1) an absence of birds on the lek during at least 2 ground surveys separated by at least 7 days. These surveys must be conducted under ideal conditions (4/1-5/7, no precipitation, light or no wind, ½ hour before to 1 hour after sunrise) or, 2) a ground check of the exact known lek site late in the strutting season (after 4/15) that fails to find any sign (droppings/feathers) of strutting activity. Data collected by aerial surveys may not be used to designate inactive status.
- **unknown** – Leks for which status as active or inactive has not been documented during the course of a strutting season. Except for those leks not scheduled for checks in a particular year, use of this status should be rare. Leks should be checked with enough visits to determine whether it is active or not. It is better to have two good checks every other year and confirm it "inactive" than to check it once every year, not see birds, but remain in "unknown" status.

Management status - Based on its annual status, a lek is assigned to one of the following categories for management purposes:

- **occupied lek** – A lek that has been active during at least one strutting season within the prior ten years. Occupied leks are protected through prescribed management actions during surface disturbing activities.
- **unoccupied lek** – (Formerly "historical lek".) There are two types of unoccupied leks, "destroyed" and "abandoned." Unoccupied leks are not protected during surface disturbing activities.
- **destroyed lek** – A formerly active lek site and surrounding sagebrush habitat that has been destroyed and is no longer suitable for sage-grouse breeding. A lek site that has been strip-mined, paved, converted to cropland or undergone other long-term habitat type conversion is considered destroyed. Destroyed leks are not monitored unless the site has been reclaimed to suitable sage-grouse habitat.

- **abandoned lek** – A lek in otherwise suitable habitat that has not been active during a period of 10 consecutive years. To be designated abandoned, a lek must be "inactive" (see above criteria) in at least four non-consecutive strutting seasons spanning the ten years. The site of an "abandoned" lek should be surveyed at least once every ten years to determine whether it has been re-occupied by sage-grouse.
- **undetermined lek** – Any lek that has not been documented active in the last ten years, but survey information is insufficient to designate the lek as unoccupied. Undetermined leks will be protected through prescribed management actions during surface disturbing activities until sufficient documentation is obtained to confirm the lek is unoccupied. Use of this status should be rare (see "unknown" above).

Winter Concentration Area - During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. Sage-grouse tend to select wintering sites where sagebrush is 10-14 inches above the snow. Sagebrush canopy cover utilized by sage-grouse above the snow may range from 10 to 30 percent. Foraging areas tend to be on flat to generally southwest facing slopes or on ridges where sagebrush height may be less than 10 inches but the snow is routinely blown clear by wind. When these conditions are met, sage-grouse typically gain weight over winter. In most cases winter is not considered limiting to sage-grouse. Under severe winter conditions grouse will often be restricted to tall stands of sagebrush often located on deeper soils in or near drainage basins. Under these conditions winter habitat may be limiting. On a landscape scale, winter habitats should allow sage-grouse access to sagebrush under all snow conditions.
Large numbers of sage-grouse have been documented to persistently use some specific areas which are characterized by the habitat features outlined above. These areas should be delineated as "winter concentration areas". Winter concentration areas do not include all winter habitats used by sage-grouse, nor are they limited to narrowly defined "severe winter relief" habitats. Delineation of these concentration areas is based on determination of the presence of winter habitat characteristics confirmed by repeated observations and sign of large numbers of sage-grouse. The definition of "large" is dependent on whether the overall population is large or small. In core population areas frequent observations of groups of 50+ sage-grouse meet the definition while in marginal populations group size may be 25+. Consultation and coordination with the WGFD is required when delineating winter concentration areas.

Appendix 3: PfM – A New Tool for the Prioritization of Responses to Mitigation Triggers

Joe Budd, JIO/PAPO Agriculture Program Coordinator, Wyoming Department of Agriculture, Natural Resources & Policy Division

Background
Although there are currently a number of tools available to estimate animal use of areas and prioritize an order of mitigation the need for a simpler method that requires less specialization has been recognized. With the use of ArcGIS and Microsoft Excel, programs available in most field offices and to every person in the Pinedale Anticline Project Office (PAPO), one possible method has been developed. The main intention of this model is to not only create a fair representation of the wildlife use in areas where mitigation is required, but to also represent all other interests, such as gas development and agriculture, in the area and provide the agencies associated with a way to prioritize on-the-ground evaluations, saving time and money during field seasons and allowing action to be taken at a quicker pace. The foreseen increase in productivity during field seasons is expected to lead to quicker responses to mitigation triggers and therefore an expedited alleviation of stress to the species, when quick responses are appropriate or achievable.

Recently, a mitigation trigger was hit for sage grouse in the Duke's Triangle complex in the Pinedale Anticline Project Area (PAPA). In accordance with the Anticline Record of Decision (ROD) and the Wildlife Monitoring and Mitigation Matrix (WMMM) action must be taken. In an effort to expedite a response and avoid implementing projects in areas that would have little or no positive impacts to the species, this new tool was used. This tool was created, in part, upon the notion of ecosystem assessments, whereas:

"…ecosystem assessments are tools for gathering relevant, available scientific and other information and organizing it in a way that establishes (1) meaningful context for subsequent action, and (2) a sound basis for priority setting. Assessments do not make decisions – they do not commit resources or narrow decision space. Instead, assessments inform our planning and decision-making processes" (Magee, 2005).

This tool may provide a way for those preparing to implement mitigation projects to prioritize on-the-ground inspections and evaluations based upon estimations of bird populations and use patterns in the PAPA. Since the trigger was hit in the Duke's Triangle complex, any projects implemented within the area are considered on-site mitigation. Any action taken within the PAPA is considered near-site and anything outside of the PAPA is considered off-site mitigation. According to the ROD, on-site should be attempted first and then mitigation efforts should move to near-site and finally off-site. One of the goals of this method of prioritization is to identify areas where quick responses may lead to positive responses in sage grouse populations. This may lead to overflow from improved areas into areas with lower population numbers, therefore increasing distribution and population numbers throughout the entire area.

Data and Buffers

Given that the triggers identified in the WMMM are based upon population numbers, this tool uses population monitoring data from previous seasons to estimate where and when sage grouse utilize areas within the PAPA. Sage grouse data included information on occupied and un-occupied leks, winter concentration areas, nesting areas and bird observations from radio collaring and observations that were recorded by in-the-field personnel. Vegetative data and specific bird numbers are not used in this method because that is beyond the purpose of this tool.

Most of the data sets were expanded upon to create shapes that provide estimates of use for regions within the PAPA. Lek points and buffers were not altered in any way but in some cases the potential mitigation regions overlap leks and lek buffers. This is considered acceptable for use in this model due to the necessity to represent bird use of these regions. Whatever party is responsible for actual field implementations will be required to follow all restrictions associated with lek buffers and comply with the Governor's Executive Order. The Governor's Core Areas are included in this model to represent areas in which mitigation projects may benefit birds on the local level while satisfying portions of the Governor's Core Area Strategy.

Current disturbances within the PAPA from natural gas activities were mapped and buffered fifty (50) meters. This buffer was used to show that no mitigation is assumed to be attempted directly adjacent to any current disturbances. Natural gas pipelines were not mapped or considered in this model as a disturbance to sage grouse.

Some Potential Mitigation Regions (PMR's) cover portions of future Development Areas (DA's) and even some current DA's (see Duke's Triangle in Map Appendix). This is considered to be acceptable due to the current pace of development (from 2008 to December of 2010 approximately 1000 wells were spudded, from 2011 to date approximately 500 wells have been spudded) and to illustrate that it may be possible for multiple uses to occupy one area. However, the broad assumption is that the further away from development a mitigation project is, the higher the likelihood of success. Mainly, the assumption is that a larger region will provide more chances for birds to avoid development when they feel the need to. This includes noise, traffic and other disturbances that may be associated with gas development

(Holloran, 2005; Walker et al, 2007; Northrup & Wittemyer, 2013). This assumption can be seen in the formula; larger areas are pre-weighted to have higher scores. However, they are not weighted so heavily that a smaller region cannot have a higher potential score, which is the case in some areas (Table 1, Fig. 1).

Population data was buffered in some cases in an effort to create a more comprehensive estimate for the regions. Nesting evidence and bird observations were buffered one quarter (.25) of a mile and combined into one set of data called 'nesting/observed use'. One quarter mile was chosen to account for inaccuracy and convey the assumption that bird activity may be seen in one place but that animal has the ability to move wherever it chooses. It is also felt that this buffer is a fair representation that does not over-compensate the birds or under-compensate other parties involved, such as natural gas companies or agricultural activities in the area. This buffer may also provide an estimate for bird movement from leks to nesting grounds, although it is much lower than most other estimates (Wallestad & Pyrah, 1974). Winter concentration areas, as mapped by the BLM, were not changed or re-shaped in any way and are assumed to be accurate.

Drawing the Regions

The data that is available at this time was used to create regional profiles. Some data sets are older than others but for the purposes of this tool, they are all considered relevant. Regions were drawn by following disturbance buffers, winter concentration areas, sage grouse complex areas and areas that seemed to show differences in bird use after buffers were drawn around nesting/observed points. This part of the process requires a large amount of decisions based upon the judgment of the person creating the maps. For example, the southern border of Duke's Triangle: Potential Mitigation Region 7 (DT: PMR-7) follows the southern edge of a winter concentration area and a lek buffer. The western and northern edges follow disturbance buffers and the eastern edge follows a disturbance buffer and a sage grouse complex area outline.

Although birds from other regions within Duke's Triangle may move and use these winter concentration areas as well, the majority of the use appears to come from birds moving north to south near the winter concentration area itself. Topography may account for some use patterns but was not part of this model. The use of topographic data may aid in more accurately delineating PMR's in the future and add to our understanding of the way these areas are used at different times of the year. It may also be noted that PMR's were not drawn in some places, mainly within DA's and where gas development is more concentrated. Although there is a small possibility that mitigation projects may benefit birds in these areas, this model assumes that larger concentrations of development will discourage birds from using these areas.

In the case that data sets overlap each other, such as winter concentration areas and nesting/observed areas, it is assumed that these regions are more crucial to sage grouse's year round health and survival. Some of these areas may only be used transitionally or during certain life stages, but that does not downplay their importance to sage grouse (Connelly, 2000). In other cases, groups of birds may use one area for all the portions of their life cycle and not migrate far from one area to the next during different seasons (Connelly, 1988). Maps of these areas, with details, can be found in the Map Appendix.

Interpreting the Data

After all the regions were drawn and the data sets were created, there was a need to attempt to measure the findings. Traditionally, this would be done intuitively by personnel in the field and may take an entire field season to complete. Intuitive interpretations of these areas can also vary drastically depending on experience, familiarity with the area and field personnel's personal biases. This model takes away many of these problems and only leaves large amounts of interpretation in the hands of the person actually drawing the regions. Although this may also seem to involve a large amount of bias, the person drawing

the regions is restricted to shapes and data points that represent only numbers and are in no way a reflection of on-the-ground conditions that commonly create biases.

By using this method, personnel can prioritize field work and go directly to areas that seem to be more likely to provide successful outcomes after project implementation and evaluate them. This not only allows field personnel to break an area into manageable regions that could accurately be evaluated in one field season, but gives them the option to implement projects in the same field season.

After all of the PMR's were drawn, the area (in acres) was calculated for each region and added to Table 1. Area measurements were also calculated for winter concentration areas and nesting/observed areas and added to the table. In many cases, there was a significant amount of overlap between winter concentrations and nesting/observed areas. The amount of overlap was calculated and added to the table. Distances (in miles) to occupied and un-occupied leks were found to estimate the likelihood of birds from any region using, or returning to, the leks. If a PMR contains a lek within it, the value for distance to lek is zero. Acres of any region within the Governor's Core Areas was also calculated and added to the table. To find percentages of use for each area, the amount (in acres) of non-utilized portions of each region was calculated and added to the table. Once all of the necessary data was added to the table, percentages were calculated for use of a region and amount in the Governor's Core Areas. Region sizes were summed to find the total acres that are potentially available for mitigation ("Z Size").

The Formula

In order to put a number value on a region's potential for mitigation a theoretical formula was developed. The Potential for Mitigation (PfM) formula is a quantitative estimate of a region's potential for use as an area for mitigation. The ability of any area to sustain a population of any species, regardless of management practices cannot be fully evaluated from anywhere but the ground. However, in an effort to streamline the process of selecting areas in which implementing new management strategies may be most beneficial, the Potential for Mitigation formula was used. PfM may also provide a way for many different managers or agencies with different agendas and responsibilities to concur on the probability of an area becoming a significant asset to mitigation efforts, rather than a failed attempt. The implementation of a logical sequence that can be translated into a theoretical numeric value for any region provides not only an agenda for field personnel to follow but a way for the agencies involved to support the decisions they make on any project.

The formula uses numbers from the table to create a value for each PMR. This value is then compared to the percentage of use for the region to create a final value that may help field personnel prioritize their work schedule. The Potential for Mitigation formula is:

$$\mathbf{PfM} = \frac{(((\text{total use} + \text{overlap}) + 1/2\ \text{non-use}) - \text{dist. to lek, active} - \text{dist. to lek, inactive} + \%\ \text{in Gov's Core})}{\text{Total \# of Mitigation Regions in Zone}}$$

To clarify the formula, these are the steps. All the numbers come directly from Table 1 where they were already calculated.

1. (total use + overlap)

A. total use = (winter concentration + nest/observed use) – winter/nest overlap

B. overlap = acres calculated by ArcGIS

C. This is an estimate of how much any region is being used by the species. The initial response is that overlap should be subtracted from total use, rather than added, but that would not illustrate the importance of these areas. If a region is used essentially year

round (overlap) that should be viewed as an additional benefit, rather than a negative value, hence the addition of overlap rather than the subtraction.

2. (+ ½ non-use)

A. non-use = region size – total use

B. This is an estimate of the non-use of a region. It is multiplied by one half to represent that some of the area may be unsuitable for use, even under "perfect" conditions. It is added to the sum from Step 1 to show that there may be potential for expansion and that we cannot fully represent every bird or every bit of use in any area.

3. (–dist. to lek, occupied–dist. to lek, unoccupied + % in Gov's Core)

A. Distance calculated (in miles) by ArcGIS

B. % in Gov's Core = Acres in Gov's Core/Region Size

C. The two lek measurements are used to estimate the probability that the area will be beneficial to birds and may actually be used. If an area has a lek within its boundaries, as many do, then the measurement is zero and therefore does not change the score for the region.

D. The percentage of the area in the Governor's Core is used to show that the Core Strategy is recognized and if mitigation can occur in an area that falls within sage grouse Core Areas and PMR's created during this process, it is beneficial on two levels.

4. ÷ (Total number of mitigation regions in the zone)

A. This is required in order to obtain an accurate quantitative estimate of the entire zone and the importance of any single region within that zone.

After the PfM formula has been completed and values have been created it is necessary to compare the PfM value to the percentage of use (% Use) for each PMR. Since the formula is just a stepping stone to help identify areas that may be most beneficial it is necessary to compare that value to the amount of use any region is currently assumed to have. Each zone has a different number of regions within it (Duke's Triangle has 9 regions, PAPA has 28). When the percentage of use is graphed for region (Fig. 1, Fig. 2) some natural breaks occur. By assigning a color for each portion of the break it can also be assigned a numeric value. For this model, green=4, yellow=3, orange=2, and red=1 point(s). It is important to realize that simply dividing the regions into four equal sets and then assigning colors/values would not accurately represent these breaks. In this case, regions that had 40-80% use were seen as regions that provided more potential. PMR's with >80% use are not considered as beneficial on the assumption that a percentage of use that high may be nearing the carrying capacity of that region and added mitigation efforts would not be as productive or responsible. Regions with <40% use were also not considered to be as potentially beneficial.

In Duke's Triangle, there are no regions with >80% use so the top two regions (DT: PMR-7; DT: PMR-9) are considered "best" and assigned the color green (4 points). DT: PMR-4 and DT: PMR-6 are fairly similar to each other and at least 10% higher than the next lowest (DT: PMR-5) and assigned the color yellow (3 points). DT: PMR-5, DT: PMR-8 and DT: PMR-2 are similar and are assigned the color orange (2 points). DT: PMR-1 and DT: PMR-3 both have very low percentages of use and are assigned the color red (1 point). This same method was used for all of the PMR's in the PAPA. The % Use color scores were then put into Table 2.

PfM values were then graphed for all the regions and similar methods were used to assign colors to these values (Fig.3, Fig. 4). In the case of PfM values, the higher the number the higher the estimated potential and therefore colors were assigned in a somewhat different fashion. Natural breaks in the data were once again recognized and affected the color assigned to each region. The number of points for each color

remained the same (green=4, yellow=3, orange=2, red=1) and were added to Table 2. By then adding the color value assigned for each region's % Use and PfM score together a final value can be calculated for each PMR. The combined graphs (Fig. 5, Fig. 6) then show the estimated value of each region. Table 2 also assigns a final color for each region based upon its final score. With this data now in hand, field personnel can budget their time and concentrate on areas they may be more beneficial as sites for implementing mitigation projects. Lastly, these estimates may provide a way for agencies and operators to find middle ground when development expansion occurs. By targeting new development to regions that show little potential as mitigation sites, and avoiding new development in regions where populations seem to be more prolific, declines may be altered or avoided. This being said, this model is in no way a regulatory device but it may serve as a useful tool, to all parties, as an advisory document during the decision making process.

Reminder

This tool was built to serve as a guide for field personnel to budget their work and may serve as a way for an agency to justify why they implement projects where they choose to. With this information field personnel can now prioritize the order in which they complete on-the-ground assessments. By eliminating the need for extended amounts of field time and searching which is often associated with finding areas in which mitigation projects would best be placed, this model may increase the speed at which a decline may be slowed or stopped. This tool is only for identifying areas to look at first when mitigation is needed. It is not intended to show any group exactly where to implement a mitigation project, only where they might start inquiring and assessing the situation from the ground level, which is the next step in the process.

This is a logic driven sequence that helps create theories as to which areas may be best to look to first when mitigation needs to take place. With this model as a guide, it may be possible to save large amounts of irreplaceable time and resources and may serve as the means for agencies and groups to gain perspectives that will aid in the processes of mitigation.

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*All data used in creating maps and data sets was taken directly from BLM archives at the Pinedale Field Office in Pinedale, Wyoming. Age of data varies but all data is considered relevant and accurate for the purposes of this model.

Mit. Zone	Z Size	Region	Region Size	Acres in Gov's Core	% in Gov's Core	Winter Conc	Nest/Observed Use	Winter/Nest Overlap	Non-utilized	Total Use	% Use	Nearest Lek (Occupied)	Nearest Lek (UnOccupied)	Potential for Lift
Duke's	23430.72	1	405.82	0.00	0%	0	26.68	0	379.14	26.68	6.6%	2.63	1.85	23.53
Duke's	23430.72	2	673.47	79.52	12%	0	84.3	0	589.17	84.30	12.5%	2.36	2.34	41.59
Duke's	23430.72	3	1314.67	959.62	73%	0	55.82	0	1258.85	55.82	4.2%	2.47	1.78	75.75
Duke's	23430.72	4	6163.39	591.17	10%	0	2007.21	0	4156.18	2007.21	32.6%	0.4	0	453.89
Duke's	23430.72	5	1389.37	0.00	0%	0	202.22	0	1187.15	202.22	14.6%	2.1	0	88.19
Duke's	23430.72	6	597.18	458.00	77%	0	147.84	0	449.34	147.84	24.8%	3.07	1.4	40.98
Duke's	23430.72	7	6882.48	3181.41	46%	3558.4	3892.85	2057.11	1488.34	5394.14	78.4%	0	0	910.65
Duke's	23430.72	8	3694.17	1692.57	46%	0	472.23	0	3221.94	472.23	12.8%	0	0.82	231.43
Duke's	23430.72	9	2310.17	123.52	5%	0	1047.29	0	1262.88	1047.29	45.3%	1.15	0.58	186.34
PAPA	127940.53	1	3038.81	3038.81	100%	617.02	290.12	0.00	2131.67	907.14	29.9%	1.29	0.63	70.43
PAPA	127941.53	2	5640.08	4491.08	80%	983.17	1778.90	383.21	3261.22	2378.86	42.2%	0	0	156.91
PAPA	127941.53	3	8390.33	7827.81	93%	5821.44	2989.45	2768.79	2348.23	6042.10	72.0%	0	0.23	356.63
PAPA	127941.53	4	231.22	231.22	100%	0.00	30.72	0.00	200.50	30.72	13.3%	1.76	3.19	4.54
PAPA	127941.53	5	1898.32	0.00	0%	1898.32	1644.05	1644.05	0.00	1898.32	100.0%	0.42	1.41	126.45
PAPA	127941.53	6	1074.80	522.73	49%	1074.80	942.22	942.22	0.00	1074.80	100.0%	0.025	3.11	71.94
PAPA	127941.53	7	11651.61	8688.43	75%	6010.54	6392.61	4617.46	3865.92	7785.69	66.8%	0 (3)	3.82	891.89
PAPA	127941.53	8	527.69	527.69	100%	313.23	19.99	19.99	214.46	313.23	59.4%	1.3	5.8	15.51
PAPA	127941.53	9	2986.73	2804.80	94%	0.00	379.35	0.00	2607.38	379.35	12.7%	1.02	2.75	60.01
PAPA	127941.53	10	828.22	158.96	19%	0.00	0.00	0.00	828.22	0.00	0.0%	3.77	2.92	14.56
PAPA	127941.53	11	4261.27	0.00	0%	1699.64	1460.04	974.12	2075.71	2185.56	51.3%	1.69	2.32	149.77
PAPA	127941.53	12	3164.47	0.00	0%	0.00	407.88	0.00	2756.59	407.88	12.9%	2.05	1.8	63.65
PAPA	127941.53	13	13123.53	0.00	0%	8651.50	8745.51	6058.34	1784.86	11338.67	86.4%	0 (2)	3.48	653.07
PAPA	127941.53	14	2079.21	0.00	0%	840.02	1757.34	630.23	112.08	1967.13	94.6%	0.32	2.79	94.65
PAPA	127941.53	15	3239.99	0.00	0%	878.62	3007.87	829.01	182.51	3057.48	94.4%	0 (2)	0	142.06
PAPA	127941.53	16	1767.98	0.00	0%	125.66	1090.57	125.66	677.41	1090.57	61.7%	1.08	0	55.49
PAPA	127941.53	17	1797.36	480.77	27%	0.00	255.76	0.00	1541.60	255.76	14.2%	0.21	1.24	36.62
PAPA	127941.53	18	2443.43	2443.43	100%	0.00	151.58	0.00	2291.85	151.58	6.2%	1.13	1.3	46.29
PAPA	127941.53	19	15582.35	15582.35	100%	6260.52	7010.62	3672.69	5983.90	9598.45	61.6%	0 (3)	0.94	580.83
PAPA	127941.53	20	3855.12	0.00	0%	388.32	2674.53	371.39	1163.66	2691.46	69.8%	0	0.51	130.15
PAPA	127941.53	21	1641.64	1560.17	95%	37.31	562.20	24.32	1066.45	575.19	35.0%	1.46	0	40.44
PAPA	127941.53	22	5417.94	0.00	0%	1145.19	2336.76	546.08	2482.07	2935.87	54.2%	0.18	0.38	168.66
PAPA	127941.53	23	6028.04	6028.04	100%	922.64	1235.45	210.66	4080.61	1947.43	32.3%	1.49	0	149.93
PAPA	127941.53	24	1515.01	1474.39	97%	0.00	108.32	0.00	1406.69	108.32	7.1%	3.52	2.3	28.81
PAPA	127941.53	25	3405.66	834.08	24%	65.94	592.98	50.68	2797.42	608.24	17.9%	2.85	0.58	73.37
PAPA	127941.53	26	10038.17	7054.14	70%	5389.97	6543.82	3628.13	1732.51	8305.66	82.7%	0 (2)	0	457.17
PAPA	127941.53	27	8752.77	744.22	9%	4738.48	2653.45	2127.72	3488.56	5264.21	60.1%	0.67	0 (2)	326.27
PAPA	127941.53	28	3558.78	0.00	0%	0.00	14.72	0.00	3544.06	14.72	0.4%	2.43	2.31	63.64

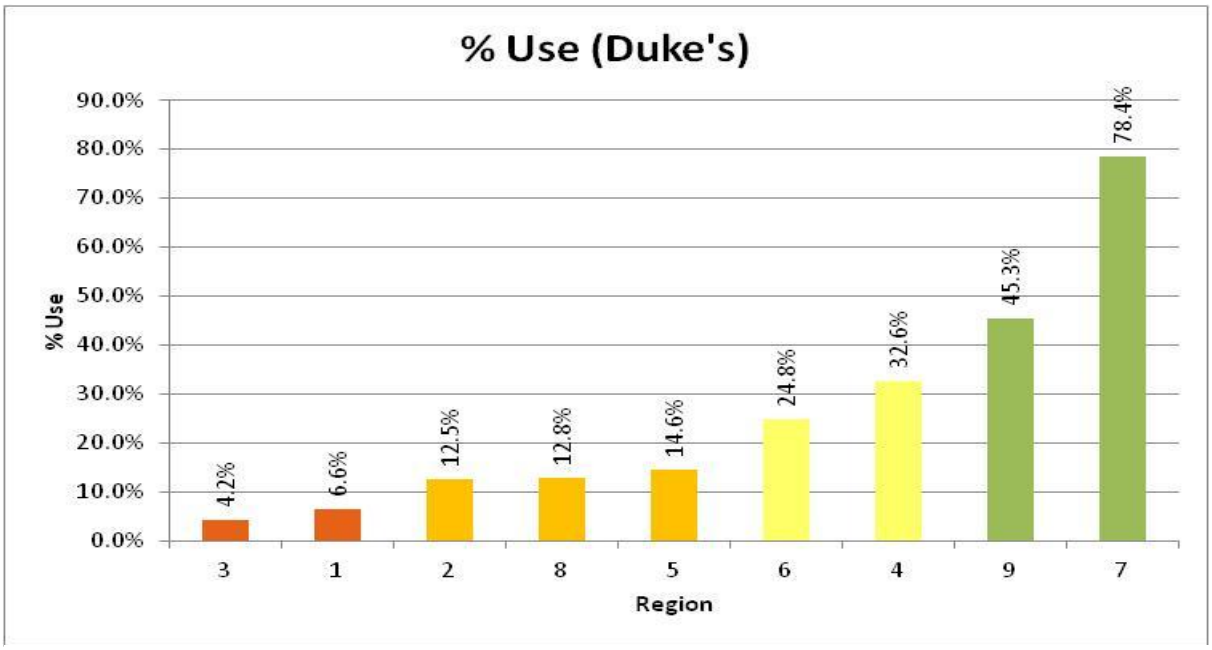


Figure 1: Percent use by PMR for Duke's Triangle. Color coded by value.

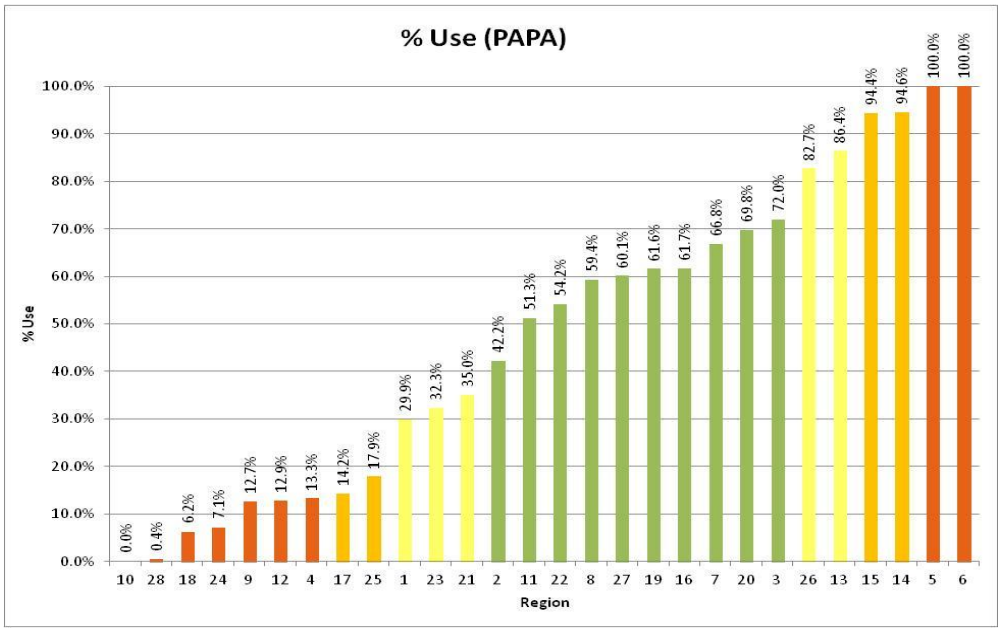


Figure 2: Percent use by PMR for PAPA. Color coded by value.

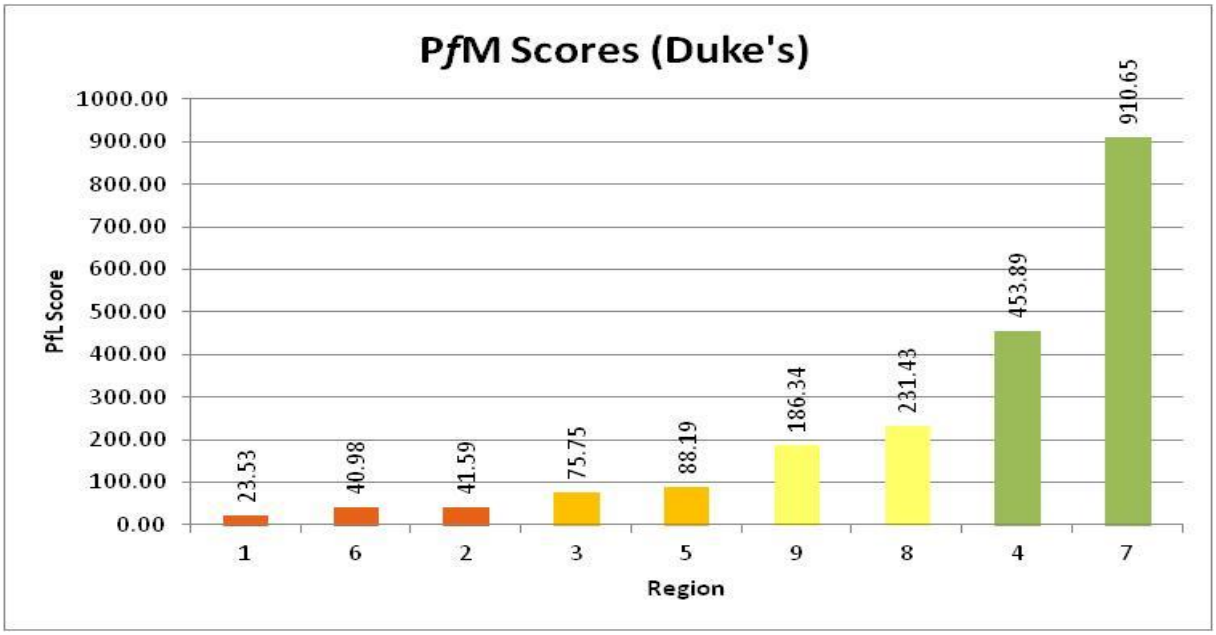


Figure 3: PfM scores for Duke's Triangle. Color coded by value.

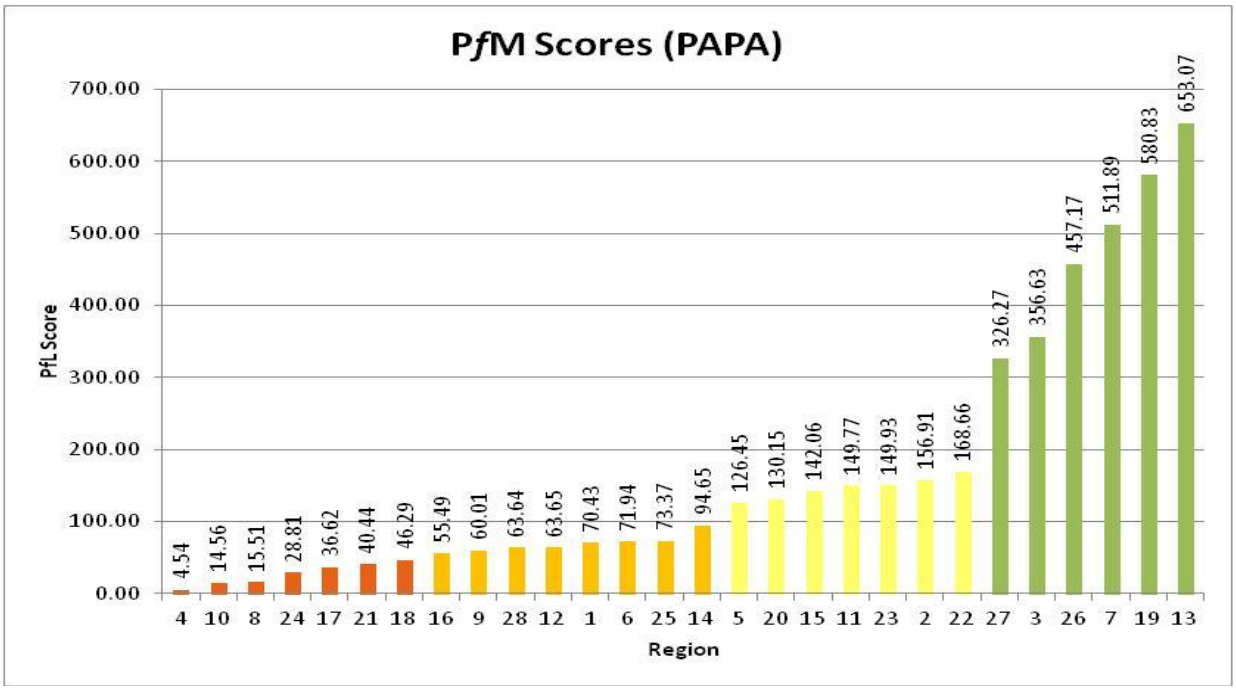


Figure 4: PfM scores for PAPA. Color coded by value.

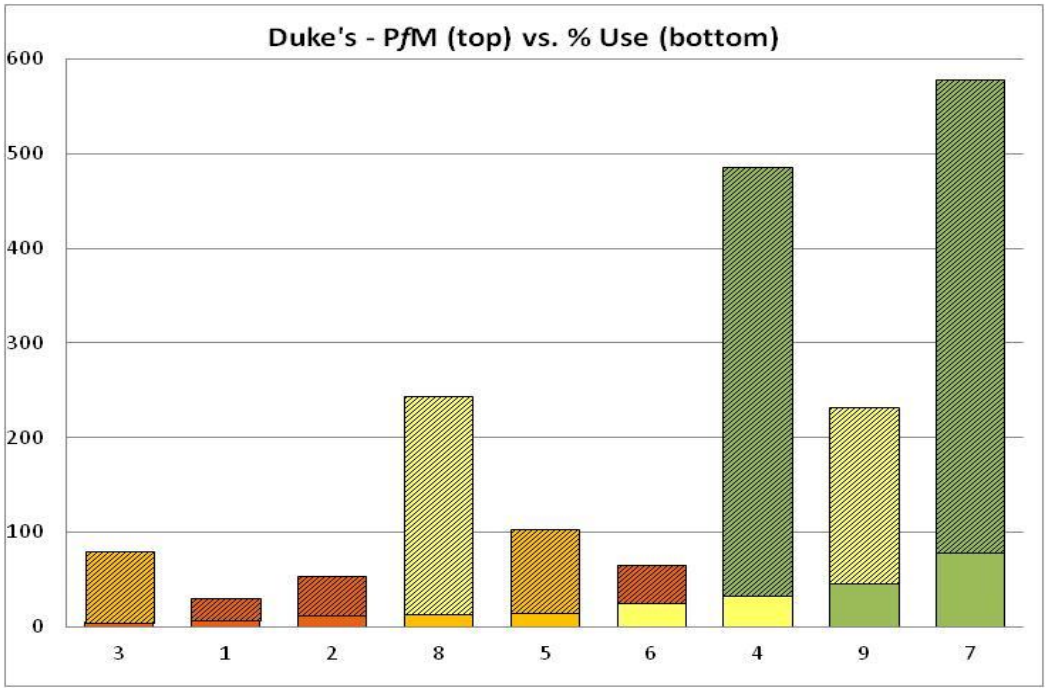


Figure 5: PfM scores (top w/ hash marks) and % Use values (bottom) for Duke's Triangle. The combination of the two numbers creates the final score for each region. (Ex: Region 7 = 8; Region 9 = 7, Region 6 = 4, etc)

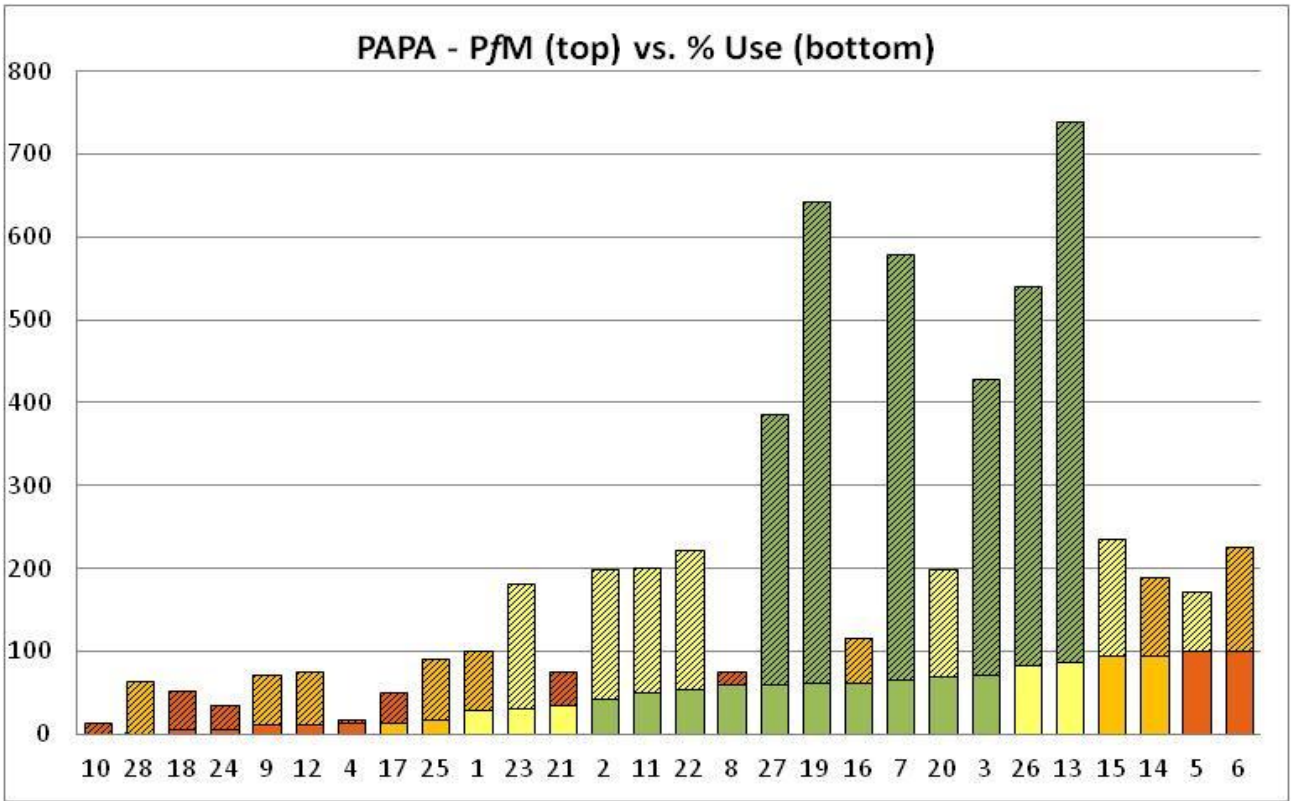
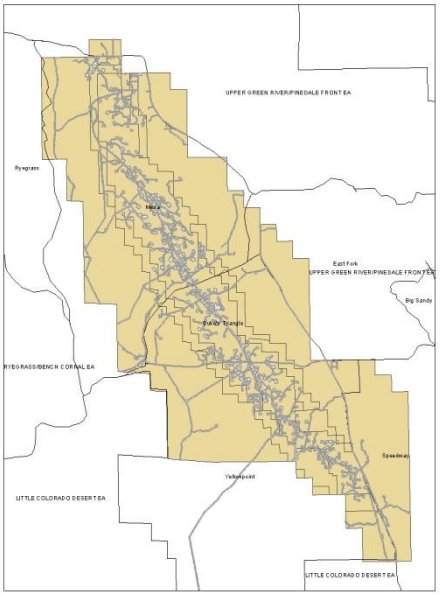


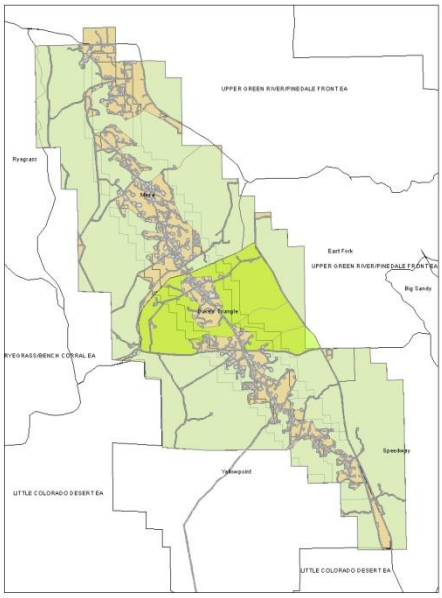
Figure 6: PfM scores (top w/ hash marks) and % Use values (bottom) for PAPA. The combination of the two numbers creates the final score for each region. (Ex: Region 19 = 8; Region 20 = 7, Region 23 = 6, Region 9 = 3, etc)

Table 2

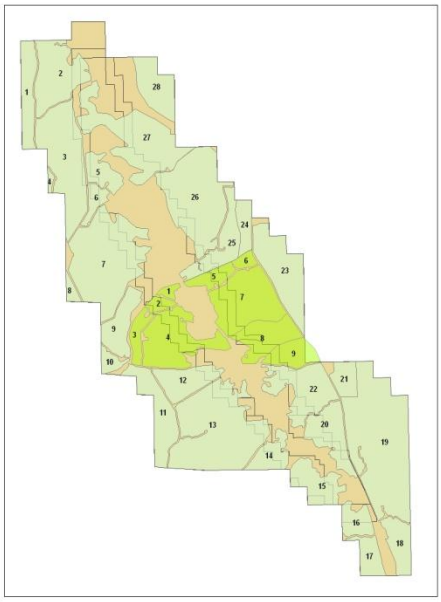
Mit. Zone	Region	% Use	PfM	% Use Score	PfM Score	Final Score	Color Code
Duke's	1	6.57%	23.53	1	1	2	
Duke's	2	12.52%	41.59	2	1	3	
Duke's	3	4.25%	75.75	1	2	3	
Duke's	5	14.55%	88.19	2	2	4	
Duke's	6	24.76%	40.98	3	1	4	
Duke's	8	12.78%	231.43	2	3	5	
Duke's	4	32.57%	453.89	3	4	7	
Duke's	9	45.33%	186.34	4	3	7	
Duke's	7	78.37%	500.00	4	4	8	
PAPA	10	0.00%	14.55756892	0	1	1	
PAPA	18	6.20%	46.28839286	1	1	2	
PAPA	24	7.15%	28.8149353	1	1	2	
PAPA	4	13.29%	4.536428571	1	1	2	
PAPA	28	0.41%	63.64321429	1	2	3	
PAPA	9	12.70%	60.0074674	1	2	3	
PAPA	12	12.89%	63.65446429	1	2	3	
PAPA	17	14.23%	36.62062453	2	1	3	
PAPA	6	100.00%	71.94183396	1	2	3	
PAPA	25	17.86%	73.3730325	2	2	4	
PAPA	21	35.04%	40.43662046	3	1	4	
PAPA	14	94.61%	94.65321429	2	2	4	
PAPA	5	100.00%	126.4478571	1	3	4	
PAPA	1	29.85%	70.43053571	3	2	5	
PAPA	8	59.36%	15.5125	4	1	5	
PAPA	15	94.37%	142.0623214	2	3	5	
PAPA	23	32.31%	149.9251786	3	3	6	
PAPA	16	61.68%	55.49482143	4	2	6	
PAPA	2	42.18%	156.9098671	4	3	7	
PAPA	11	51.29%	149.76875	4	3	7	
PAPA	22	54.19%	168.6580357	4	3	7	
PAPA	20	69.82%	130.1489286	4	3	7	
PAPA	26	82.74%	457.1695618	3	4	7	
PAPA	13	86.40%	653.07	3	4	7	
PAPA	27	60.14%	326.2723224	4	4	8	
PAPA	19	61.60%	580.8267857	4	4	8	
PAPA	7	66.82%	511.8941316	4	4	8	
PAPA	3	72.01%	356.632427	4	4	8	



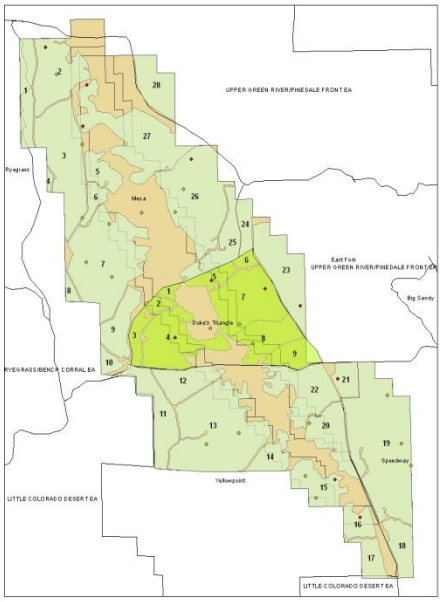
PAPA (brown) with sage grouse complexes (outlines) and disturbances with 50m buffer (grey). Duke's Triangle is labeled near the middle of the PAPA.



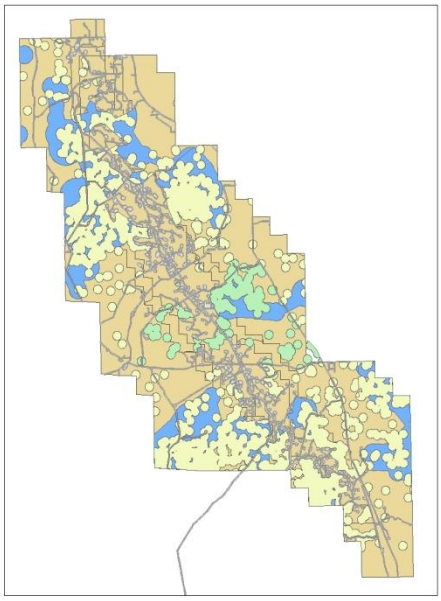
PAPA with disturbances (grey) and PMR's (light green and green). Brighter green in Duke's Triangle represents on-site PMR's. Lighter green in the PAPA represents near-site PMR's.



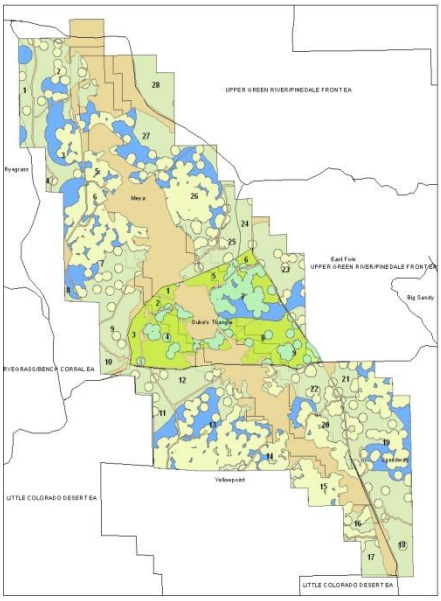
PMR's by number. Bright green represents on-site (Duke's Triangle), light green represents near-site (PAPA). Brown areas represent the development corridor and roads.



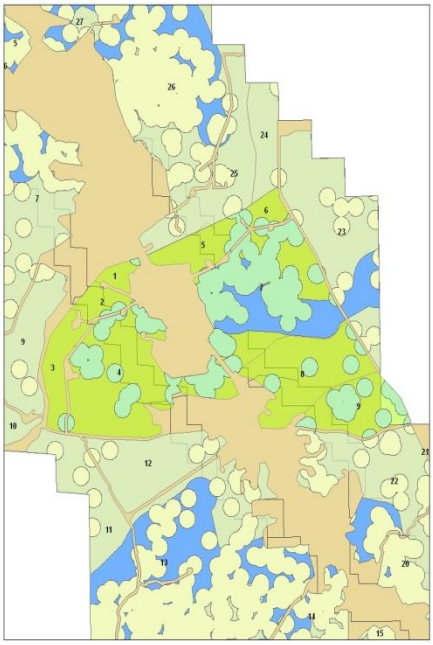
Leks within the PAPA. Green dots represent occupied leks, red dots represent un-occupied leks.



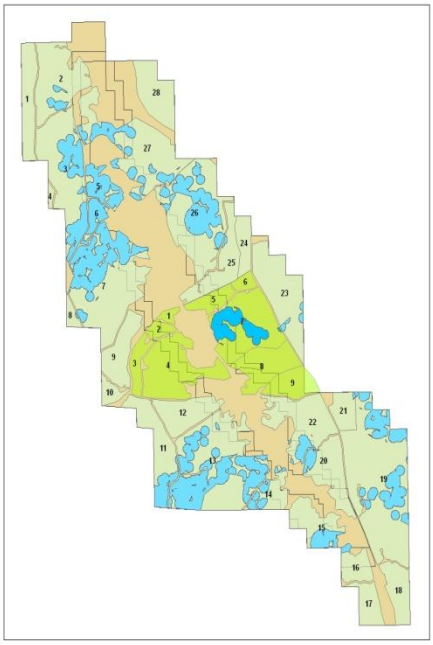
Sage grouse use (estimated). Green represents nesting/observed use in Duke's Triangle. Yellow represents nesting/observed use in PAPA. Dark blue represents winter concentration



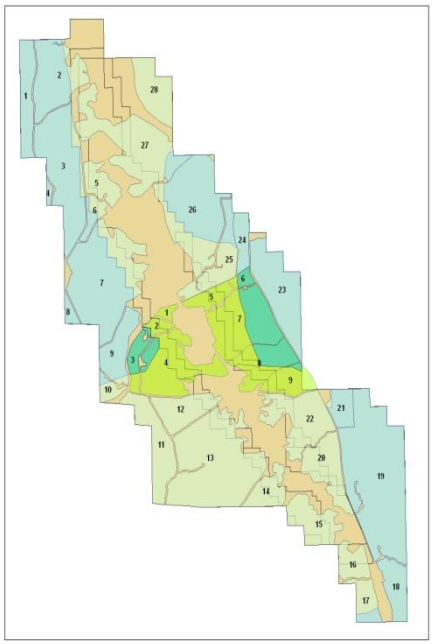
Sage grouse use estimates within PMR's and Complex areas for PAPA and Duke's Triangle.



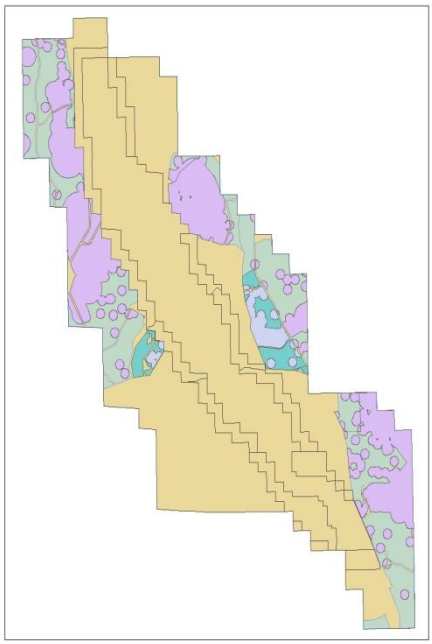
Expanded view of Duke's Triangle with PMR's and bird use. Yellow and light green represent nesting/observed use. Dark blue represents winter concentration areas.



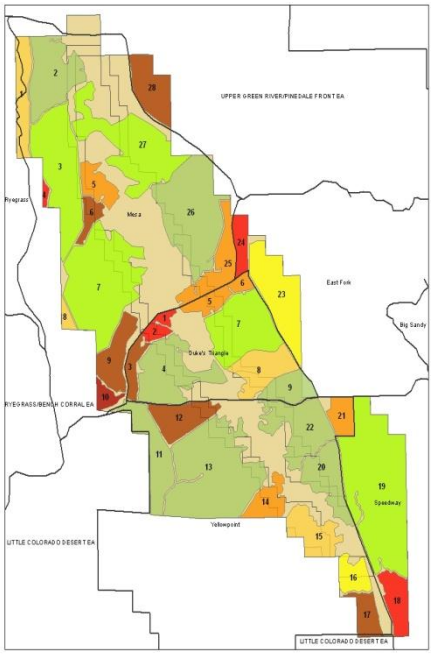
Overlapping use areas within the PAPA (blue). Blue polygons represent areas in which winter concentration overlaps with nesting/observed use.



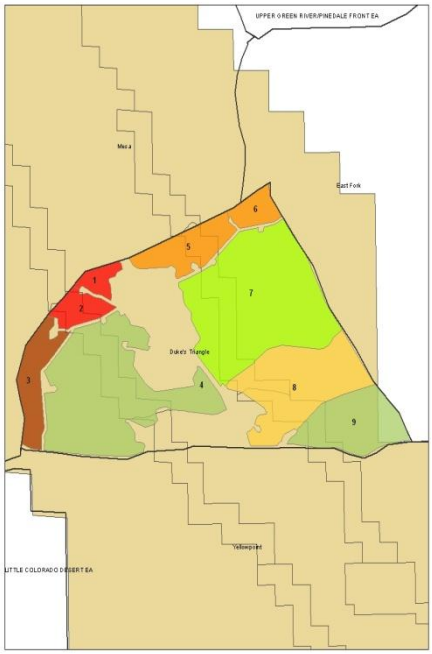
Governor's Core Areas (blue) overlapping PMR's in Duke's Triangle and PAPA.



Governor's Core Areas (blue) with total bird use in PMR's. Light and dark purple represent a combination of nesting/observed use and winter concentration areas (total use). Brown represents the PAPA.



Final Scores for PMR's in PAPA and Duke's Triangle. Colors represent values assigned to each PMR in Table 2. Spectrum runs from bright green (highest final score) to red (lowest final score).



Final Scores for PMR's in Duke's Triangle. Colors represent values assigned to each PMR in Table 2. Spectrum runs from bright green (highest final score) to red (lowest final score).